U.S. Serial Number 09/737,432   Atty. Docket # AUS9-2000-0701-US1
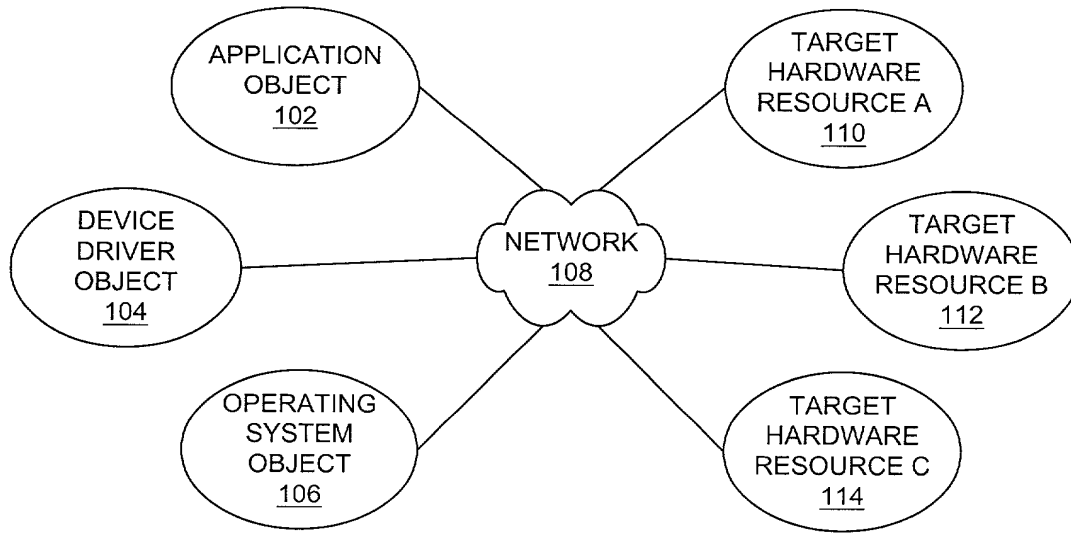**Chang et al.**
**Method and system for network management capable of restricting consumption of
resources along endpoint-to-endpoint routes throughout a network**

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FIG. 1

(PRIOR ART)

FIG. 2A

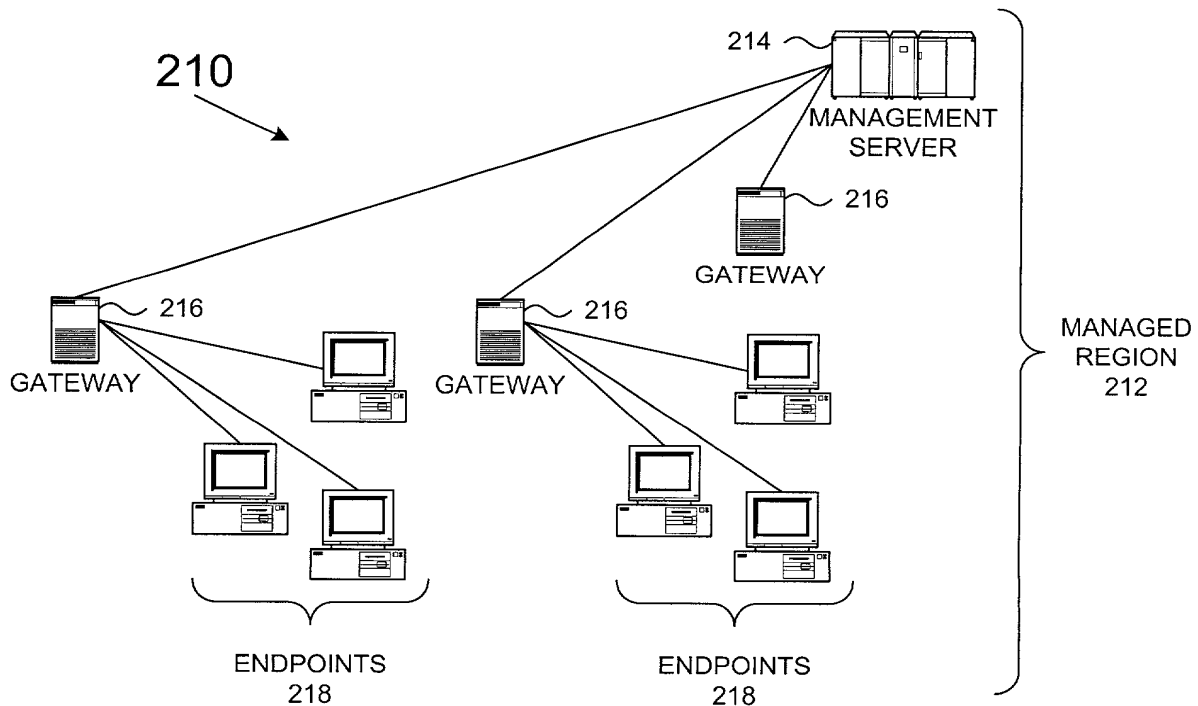**U.S. Serial Number 09/737,432   Atty. Docket # AUS9-2000-0701-US1**
Chang et al.
Method and system for network management capable of restricting consumption of
resources along endpoint-to-endpoint routes throughout a network

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GATEWAY
216

SERVER
222

ORB
221

AUTHORIZER
223

OBJECT LIBRARY
229

LOCATOR
225

BOA
227

IPC
219

THREADS
217

OS
215

ENDPOINT
218

CLIENT FRAMEWORK
224

• • •

ENDPOINT
218

CLIENT FRAMEWORK
224

FIG. 2B

CLIENT FRAMEWORK
224

DAEMON
226

RUNTIME
LIBRARY
228

FIG. 2C

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Method and system for network management capable of restricting consumption of
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BRANCH OFFICE
238

CENTRAL OFFICE
240

BRANCH OFFICE
239

ENDPOINT A
230

APPLICATION ACTION OBJECT
232

OPERATING
SYSTEM
OBJECT
236

DEVICE
DRIVER
OBJECT
234

ENDPOINT B
231

APPLICATION OBJECT
233

OPERATING
SYSTEM
OBJECT
237

DEVICE
DRIVER
OBJECT
235

FIG. 2D

ENDPOINT A
252

APPLICATION STACK
254

DISTRIBUTED KERNEL
SERVICES/JVM
255

OPERATING SYSTEM
RESOURCES
256

NETWORK
DEVICE DRIVERS
257

NIC
258

FIG. 2E

ENDPOINT B
253

APPLICATION STACK
254

DISTRIBUTED KERNEL
SERVICES/JVM
255

OPERATING SYSTEM
RESOURCES
256

NETWORK
DEVICE DRIVERS
257

NIC
258

NETWORK
250

DISTRIBUTED KERNEL SERVICES (DKS) GATEWAY
251

U.S. Serial Number 09/737,432   Atty. Docket # AUS9-2000-0701-US1
Chang et al.
Method and system for network management capable of restricting consumption of
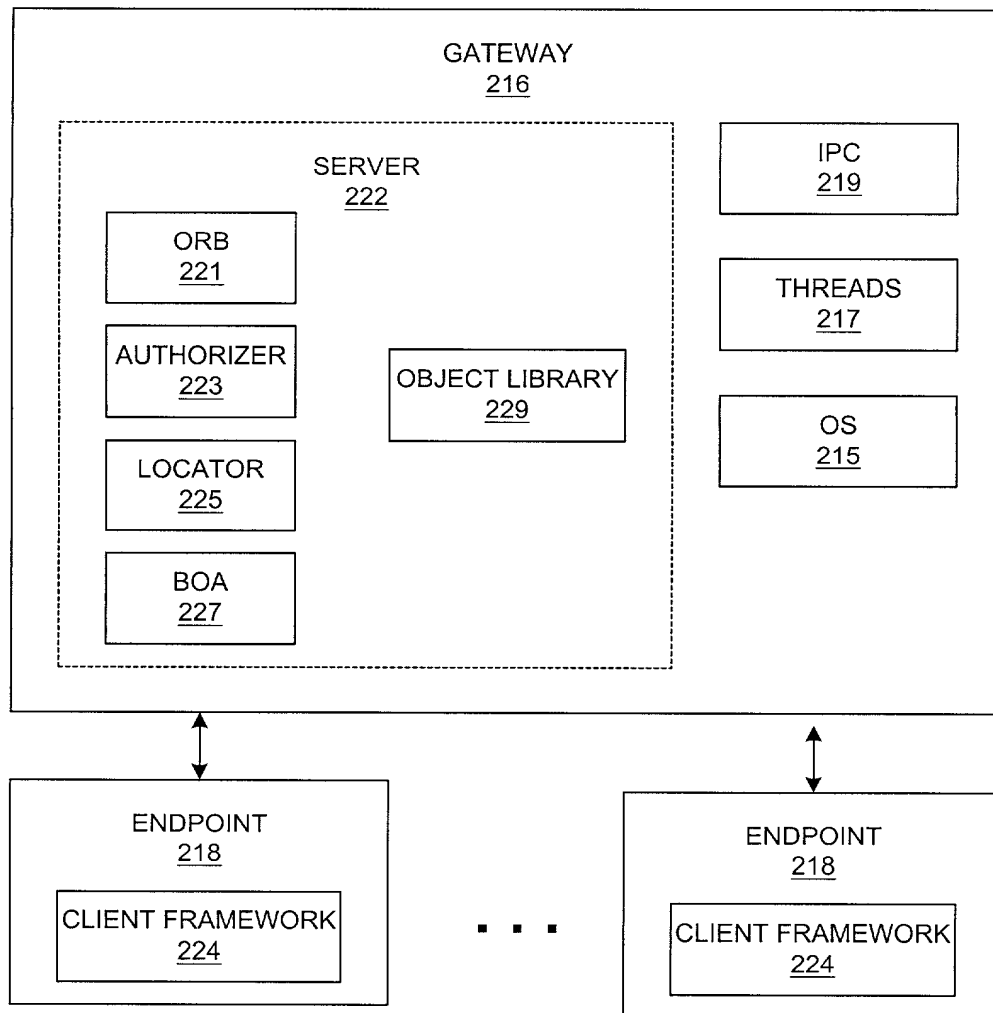resources along endpoint-to-endpoint routes throughout a network

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GATEWAY
260

NETWORK
262

NIC
264

DKS ORB
(GATEWAY)
266

DKS-ENABLED
APPLICATION A
268

DKS-ENABLED
APPLICATION B
269

FIG. 2F

GATEWAY
270

GATEWAY
280

NETWORK
272

NIC
274

DKS ORB
(GATEWAY)
276

NIC
278

NIC
282

DKS ORB
(GATEWAY)
284

NIC
286

NIC
296

NIC
292

ENDPOINT
294

ENDPOINT
290

DKS ORB
(ENDPOINT)
298

FIG. 2G

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Chang et al.
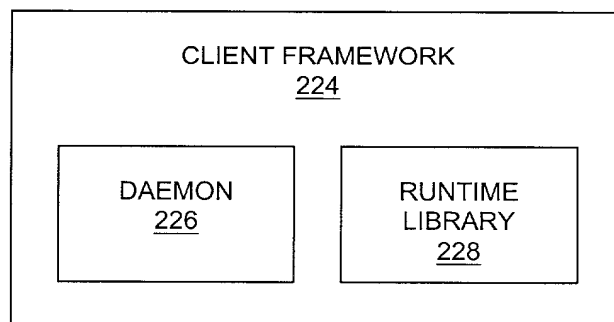Method and system for network management capable of restricting consumption of
resources along endpoint-to-endpoint routes throughout a network

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ENDPOINT A 301	GATEWAY 300	ENDPOINT B 302
DKS ORB (ENDPOINT A) 320		DKS ORB (ENDPOINT B) 322
DKS APPLICATION (RESOURCE REQUESTER) 324	ORB (DKS SERVICES) 304	TARGET RESOURCE (RESOURCE PROVIDER, OBJECT, OR APP) 326
DKS SERVICES-- ENDPOINT 330	NETWORK ENDPOINT LOCATION (NELS) SERVICE 306	DKS SERVICES-- ENDPOINT 334
	IP OBJECT PERSISTENCE (IPOP) SERVICE 308	
	GATEWAY SERVICES 310	

FIG. 3

IP OBJECT PERSISTENCE (IPOP) SERVICE DATABASE 402	ENDPOINT DB TABLE 404	SYSTEM DB TABLE 406	NETWORK DB TABLE 408
	TOPO OBJECT ⋮ TOPO OBJECT	TOPO OBJECT ⋮ TOPO OBJECT	TOPO OBJECT ⋮ TOPO OBJECT

FIG. 4

U.S. Serial Number 09/737,432   Atty. Docket # AUS9-2000-0701-US1
Chang et al.
Method and system for network management capable of restricting consumption of
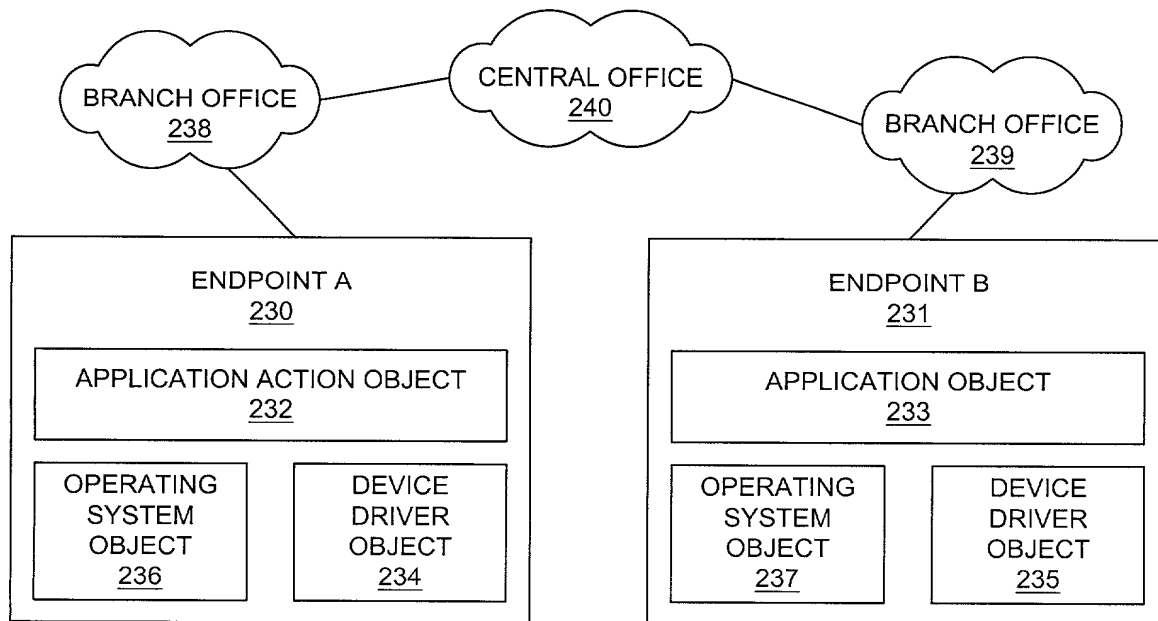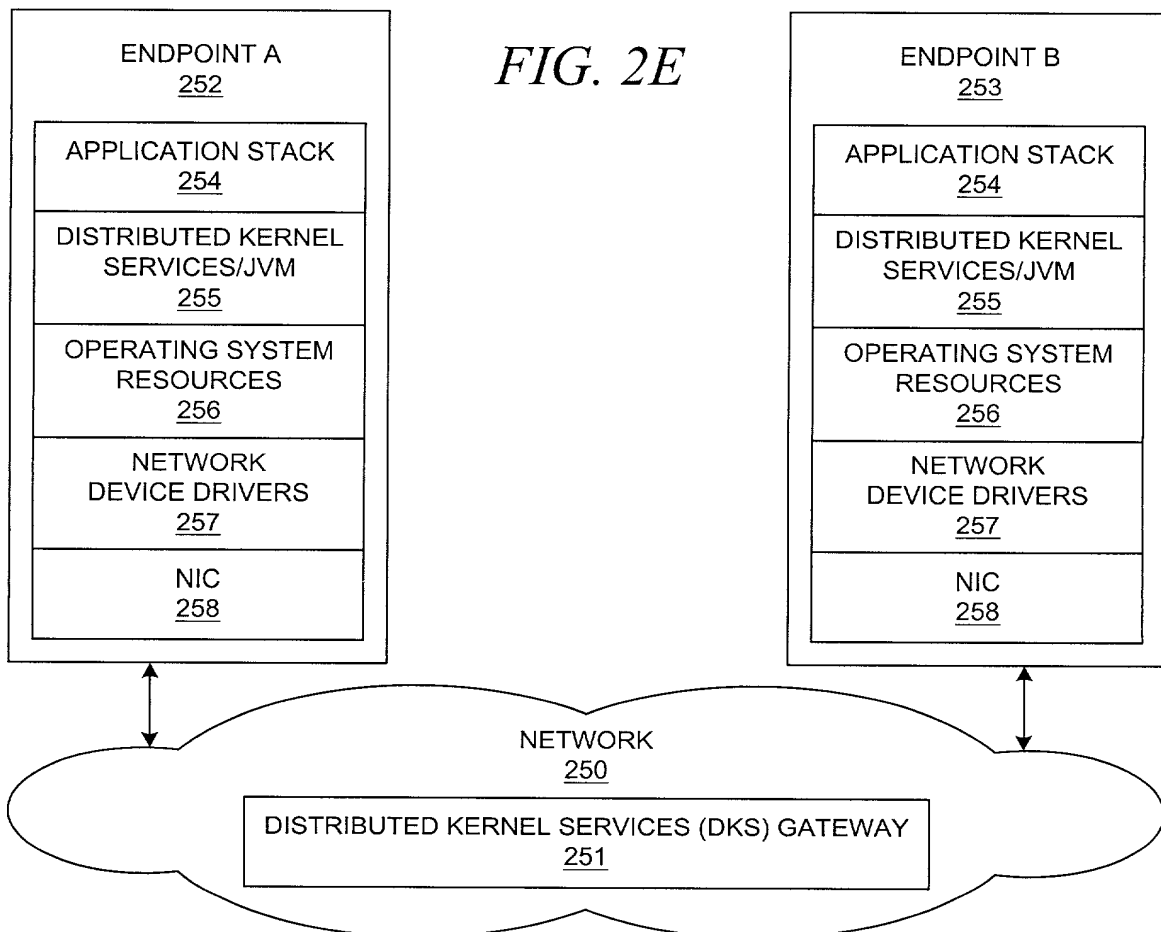resources along endpoint-to-endpoint routes throughout a network

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500

PHYSICAL IP NETWORKS
514

IP DRIVER
502

MONITOR CONTROLLER
516

DISCOVERY CONTROLLER
506

NETWORK EVENT MANAGER APPLICATION
522

CONFIGURATION SERVICE
528

IP DRIVER CONTROLLER
530

IP DATA CACHE
520

APPLICATION/ USERS
524

IP DRIVER INTERFACE
526

IP MAPPER
508

TOPOLOGY SERVICE
504

IP DATASTORE
518

IP OBJECT PERSISTENCE (IPOP) SERVICE
510

IPOP DATABASE
511

APPLICATION ACTION OBJECT (AAO) RESTRICTED SESSION ID STORAGE
512

PHYSICAL NETWORK TOPOLOGY ROUTE (ENDPOINT ORB TO ENDPOINT ORB) STORAGE
513

FIG. 5A

DRIVER 1 SCOPE (D1)

1.2.11.0   1.2.11.22

ROUTER

DRIVER 2 SCOPE (D2)

1.2.12.0

1.2.12.22

1.2.13.22   1.2.14.22

1.2.13.0   1.2.14.0

DRIVER 3 SCOPE (D3)

FIG. 5B

U.S. Serial Number 09/737,432   Atty. Docket # AUS9-2000-0701-US1
Chang et al.
Method and system for network management capable of restricting consumption of
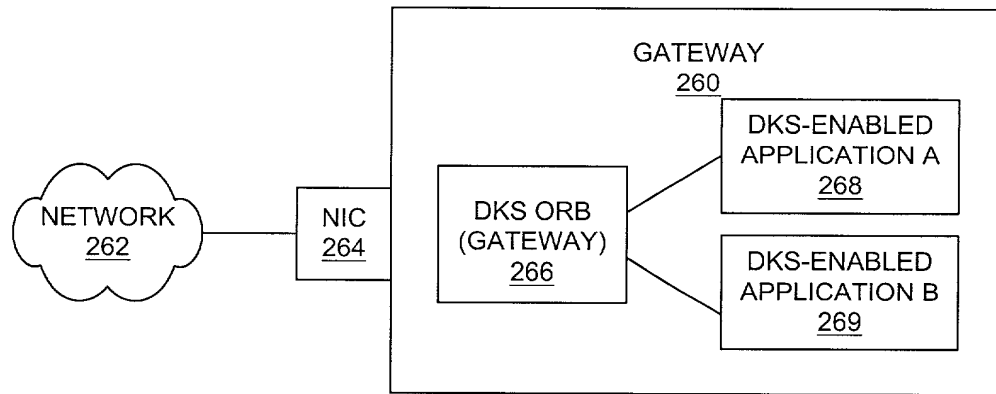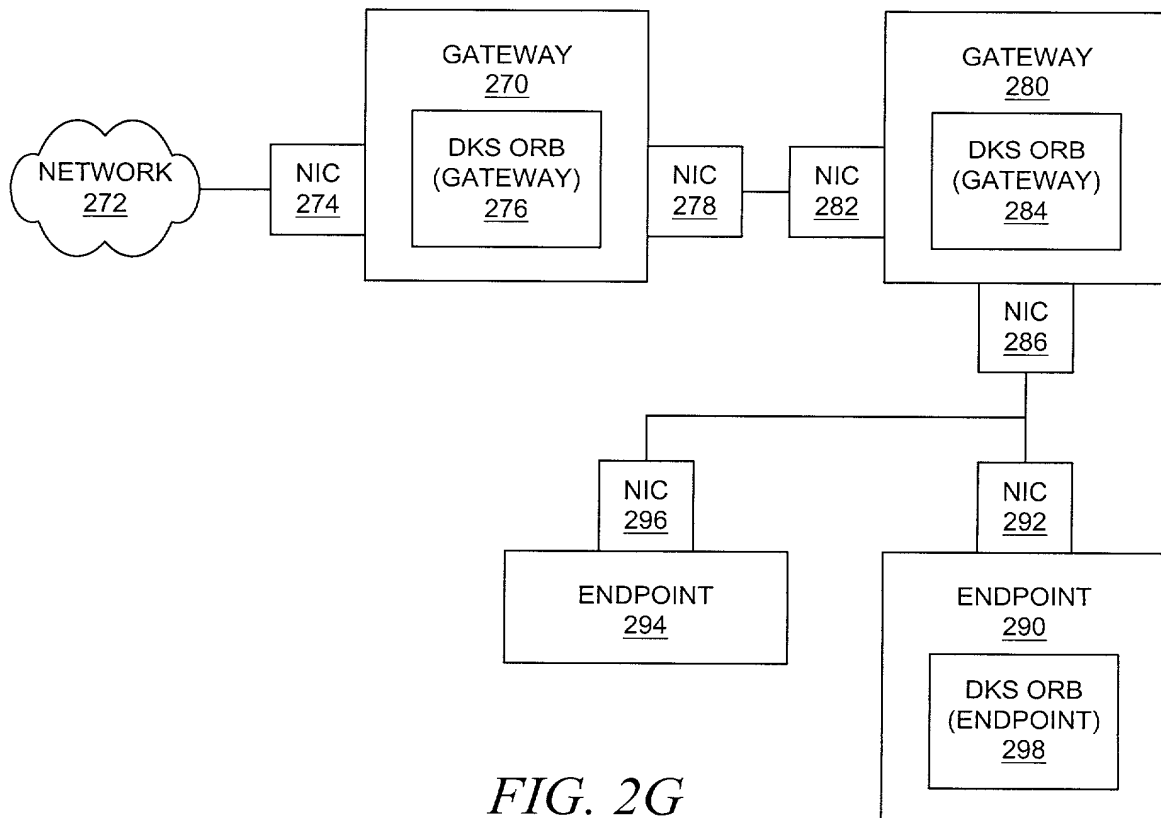resources along endpoint-to-endpoint routes throughout a network

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```
                    ┌──────────┐
                    │  BEGIN   │
                    └──────────┘
                         │
                         ▼
        ┌────────────────────────────────────┐
        │     APPLICATION REQUESTS           │
        │ APPLICATION ACTION OBJECT (AAO)    │
        │     FOR TARGET ENDPOINT            │
        │       FROM GATEWAY                 │
        │          602                       │
        └────────────────────────────────────┘
                         │
                         ▼
        ┌────────────────────────────────────┐
        │     GATEWAY ASKS NEL SERVICE       │
        │   TO DECODE TARGET ENDPOINT        │
        │          604                       │
        └────────────────────────────────────┘
                         │
                         ▼
        ┌────────────────────────────────────┐
        │      NEL SERVICE ASKS IPOP         │
        │    TO DECODE TARGET ENDPOINT       │
        │          606                       │
        └────────────────────────────────────┘
                         │
                         ▼
        ┌────────────────────────────────────┐
        │         IPOP DECODES               │
        │ ENDPOINT ADDRESS AND RETURNS       │
        │    GENERATED AAO TO NEL            │
        │          608                       │
        └────────────────────────────────────┘
                         │
                         ▼
        ┌────────────────────────────────────┐
        │     NEL SERVICE RETURNS AAO        │
        │          TO GATEWAY                │
        │          610                       │
        └────────────────────────────────────┘
                         │
                         ▼
        ┌────────────────────────────────────┐
        │     GATEWAY RETURNS AAO            │
        │       TO APPLICATION              │
        │          612                       │
        └────────────────────────────────────┘
                         │
                         ▼
        ┌────────────────────────────────────┐
        │   APPLICATION PERFORMS             │
        │     DESIRED ACTION ON              │
        │ ENDPOINT-TO-ENDPOINT ROUTE         │
        │          614                       │
        └────────────────────────────────────┘
                         │
                         ▼
                    ┌──────────┐
                    │   END    │
                    └──────────┘
```

FIG. 6A

U.S. Serial Number 09/737,432   Atty. Docket # AUS9-2000-0701-US1
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Method and system for network management capable of restricting consumption of
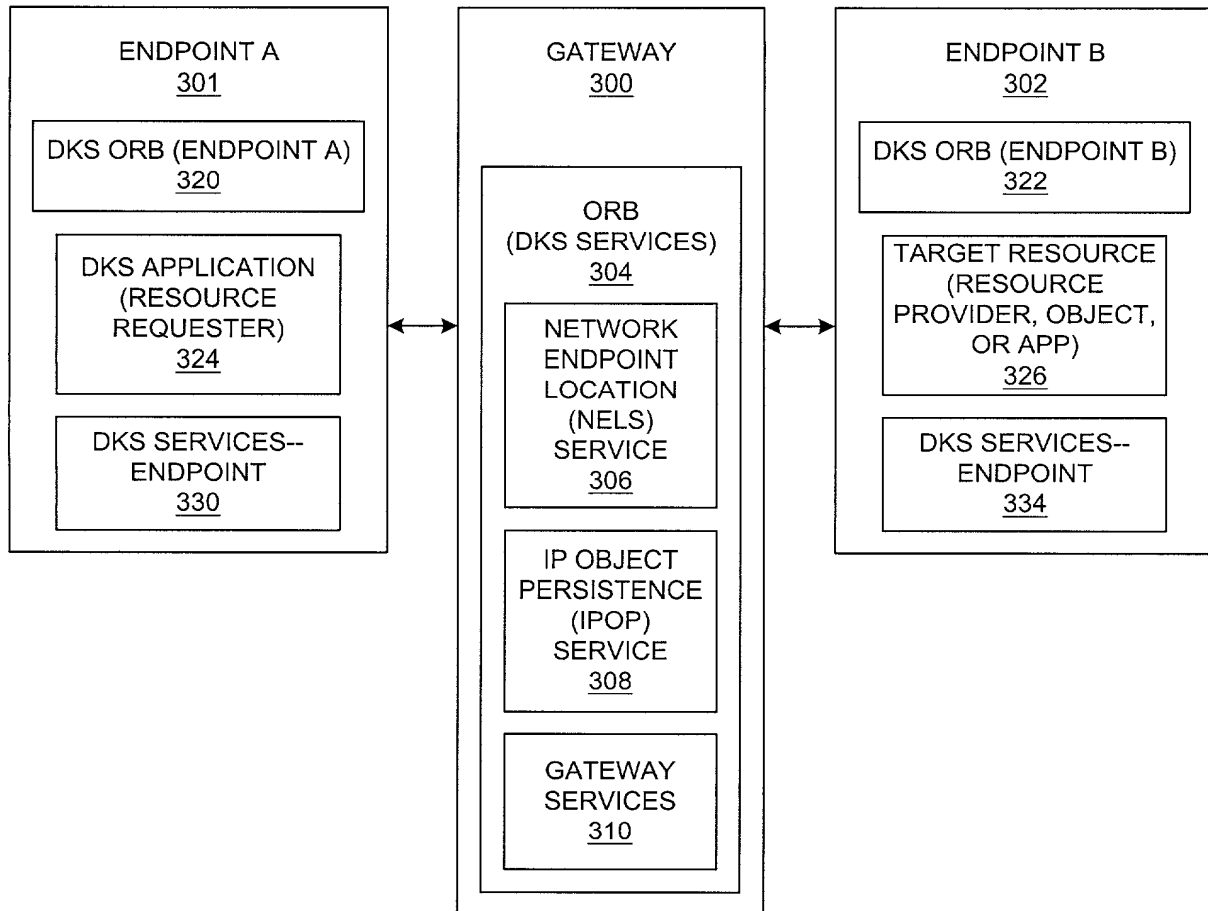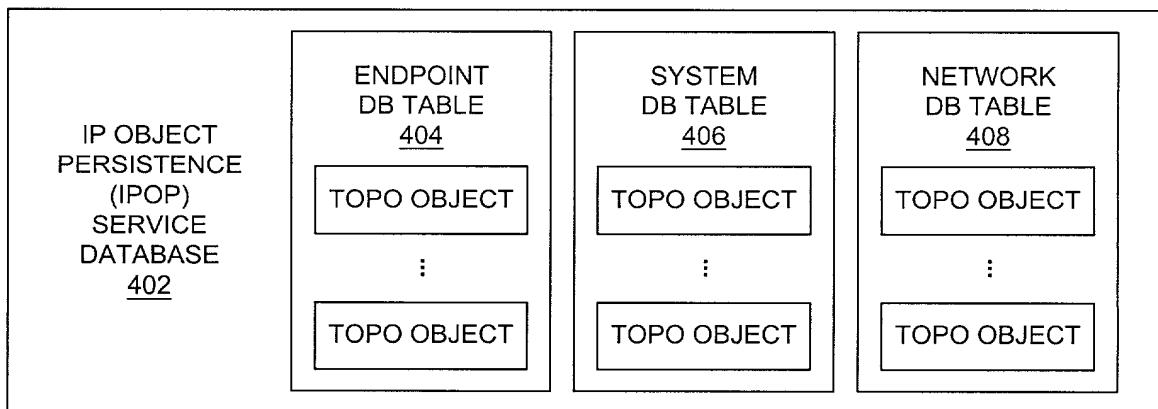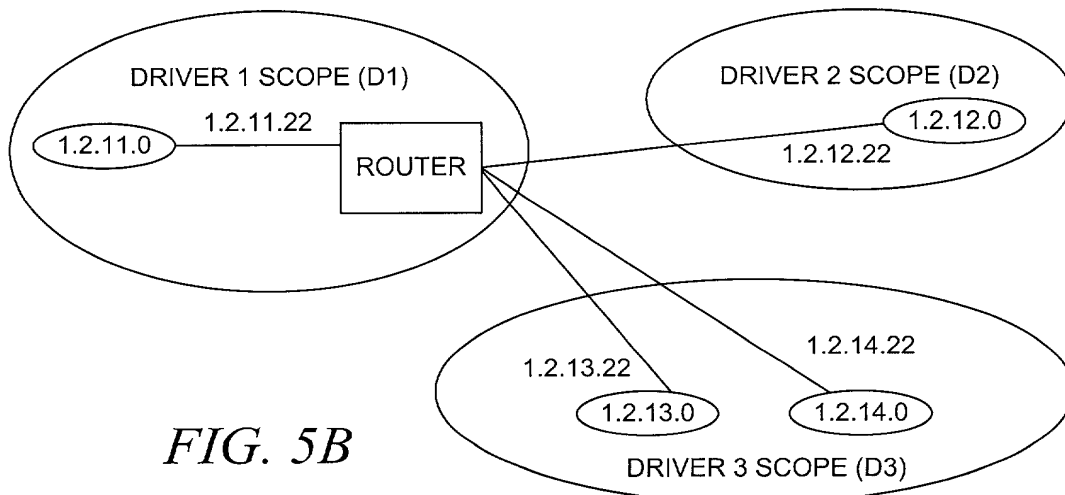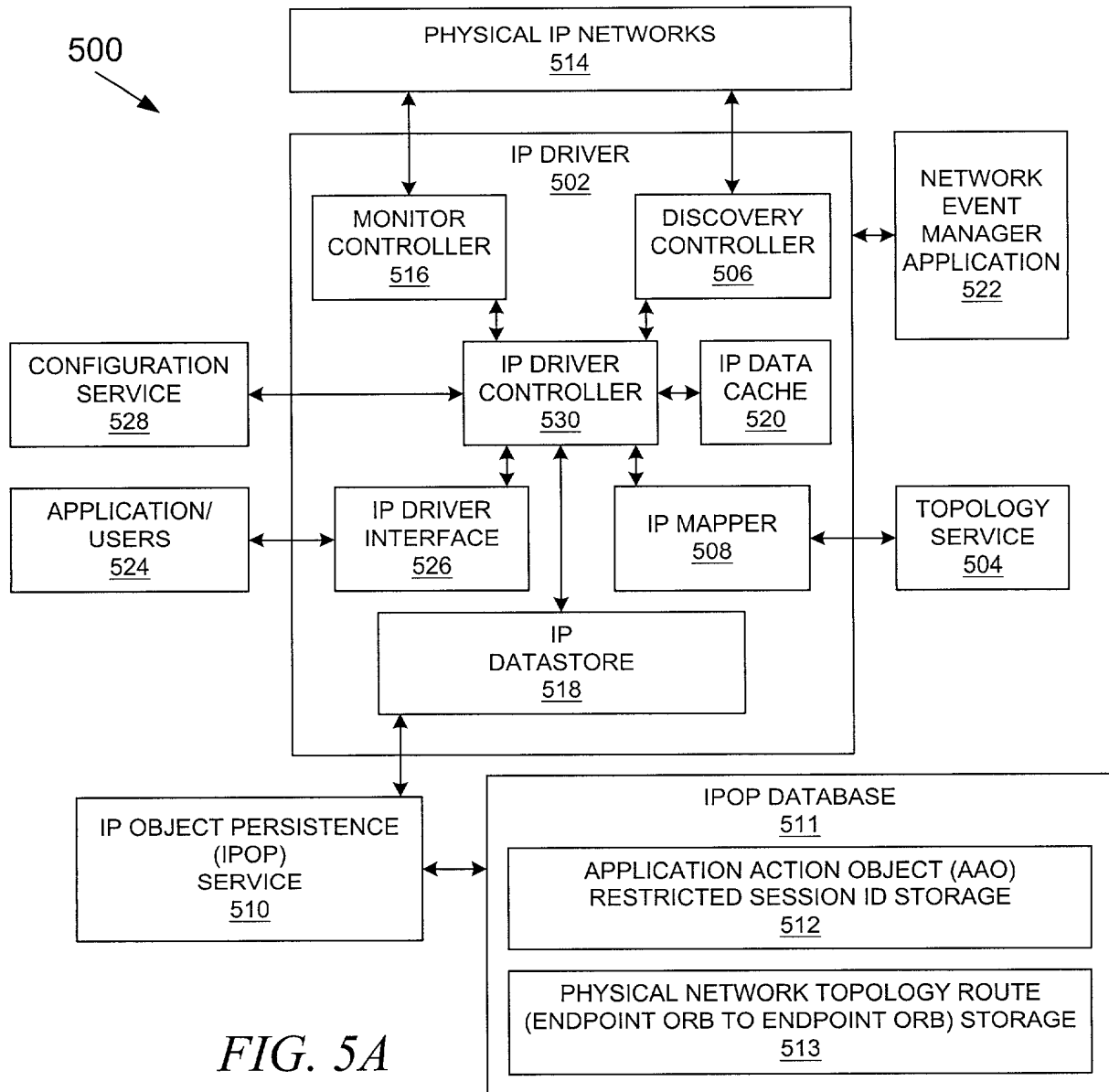**resources along endpoint-to-endpoint routes throughout a network**

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BEGIN

RESTRICT
FLAG SET FOR
TARGET ENDPOINT?
620

YES → REJECT NEL REQUEST FOR
AAO
622

NO

DOES
REQUESTED AAO
REQUIRE RESTRICTED
ROUTE?
624

YES → IPOP RESTRICTS ROUTE FOR
REQUESTED AAO
630

NO

IPOP DECODES AAO ADDRESS
AND POPULATES AAO
626

IPOP RETURNS AAO TO NEL
SERVICE
628

END

FIG. 6B

BEGIN

GATEWAY RECEIVES NOTIFICATION TO RESTRICT USE OF ENDPOINT
TO RESTRICTED SESSION NUMBER
660

GATEWAY TERMINATES ALL OTHER APPLICATION ACTION OBJECTS
662

END

FIG. 6D

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Chang et al.
Method and system for network management capable of restricting consumption of
resources along endpoint-to-endpoint routes throughout a network

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BEGIN

IPOP DETERMINES ROUTE
FROM APPLICATION/SOURCE ENDPOINT
TO TARGET ENDPOINT FOR AAO
642

IPOP DEFINES A RESTRICTED SESSION NUMBER
THAT WILL BE ASSOCIATED WITH THIS ROUTE
AND STORES IT IN AAO
644

IPOP GETS ALL ENDPOINTS
THAT EXIST IN ROUTE
646

GET NEXT ENDPOINT
AS CURRENT ENDPOINT TO BE PROCESSED
648

IPOP SETS RESTRICT FLAG
FOR CURRENT ENDPOINT
650

NOTIFY GATEWAY TO REJECT
FURTHER USAGE OF CURRENT ENDPOINT
BY OTHER APPLICATIONS
652

ANOTHER
ENDPOINT
TO BE PROCESSED?
654

YES

NO

END

FIG. 6C

U.S. Serial Number 09/737,432   Atty. Docket # AUS9-2000-0701-US1
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Method and system for network management capable of restricting consumption of resources along endpoint-to-endpoint routes throughout a network
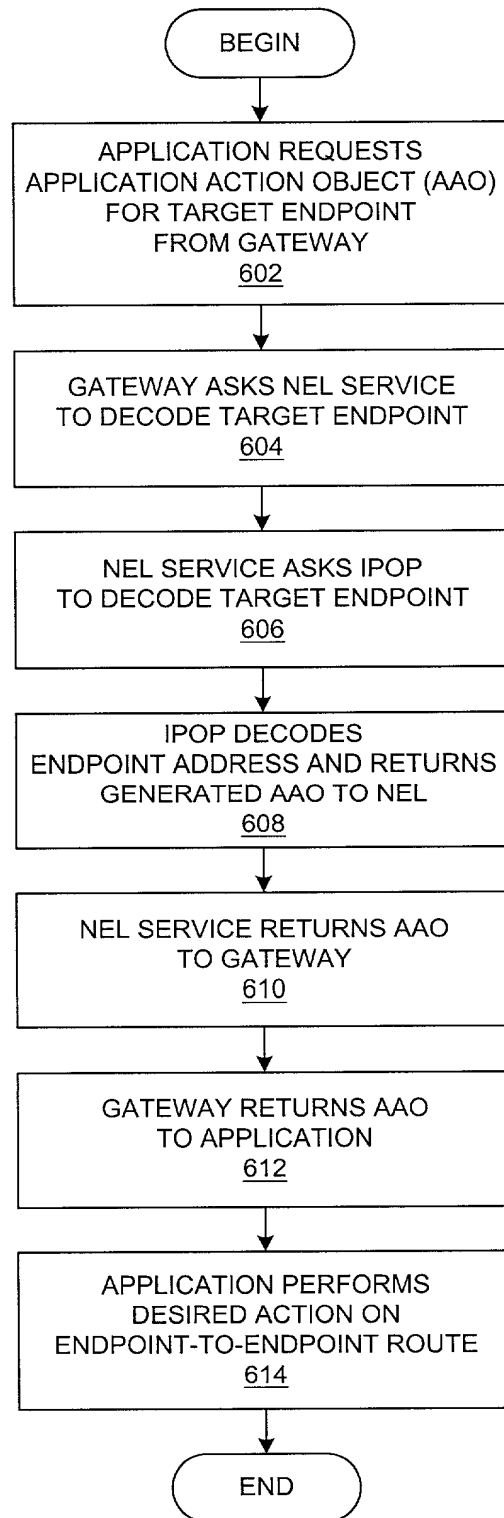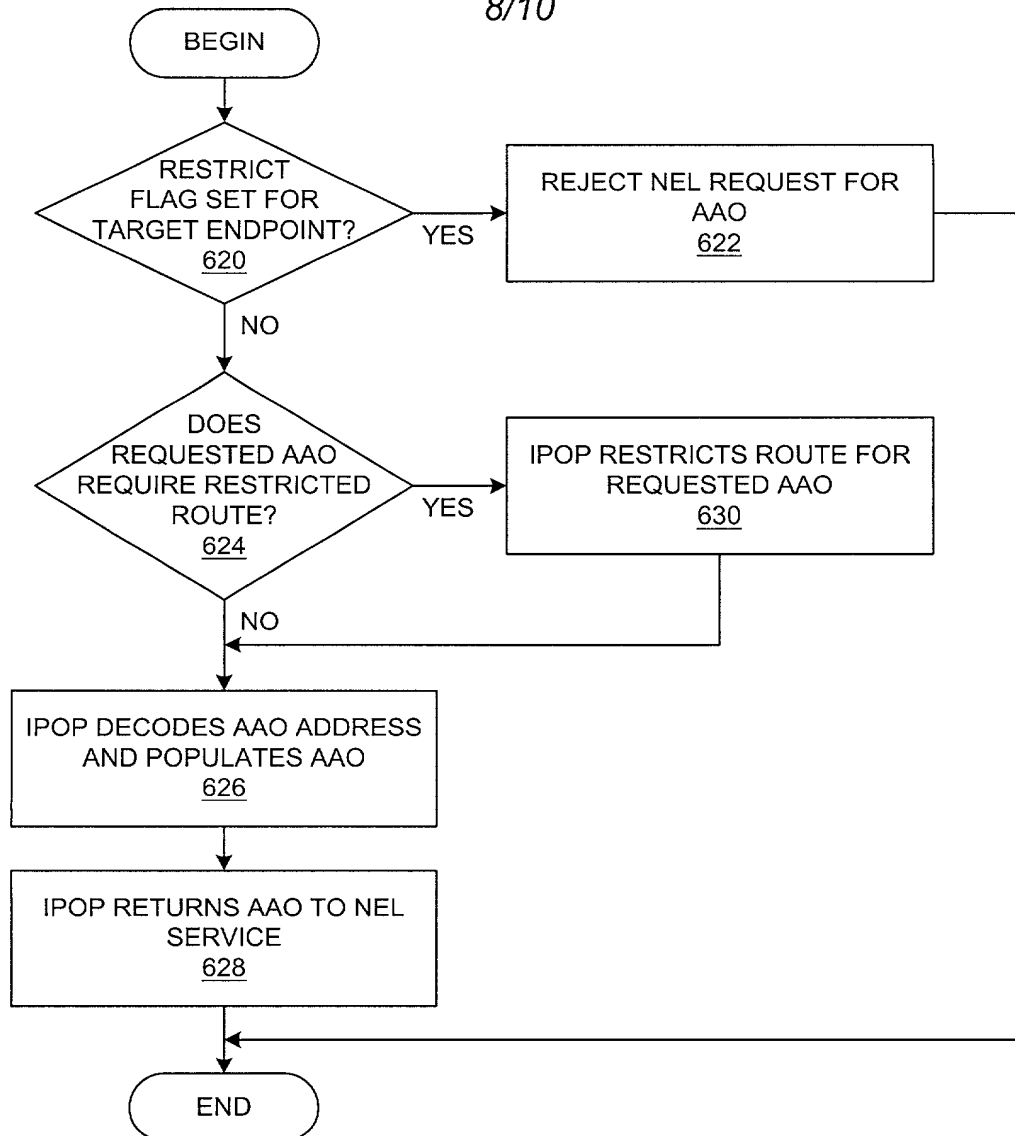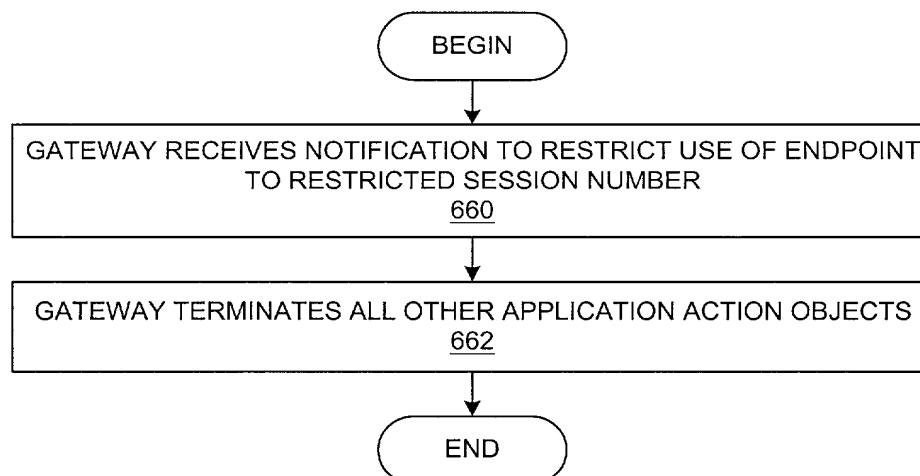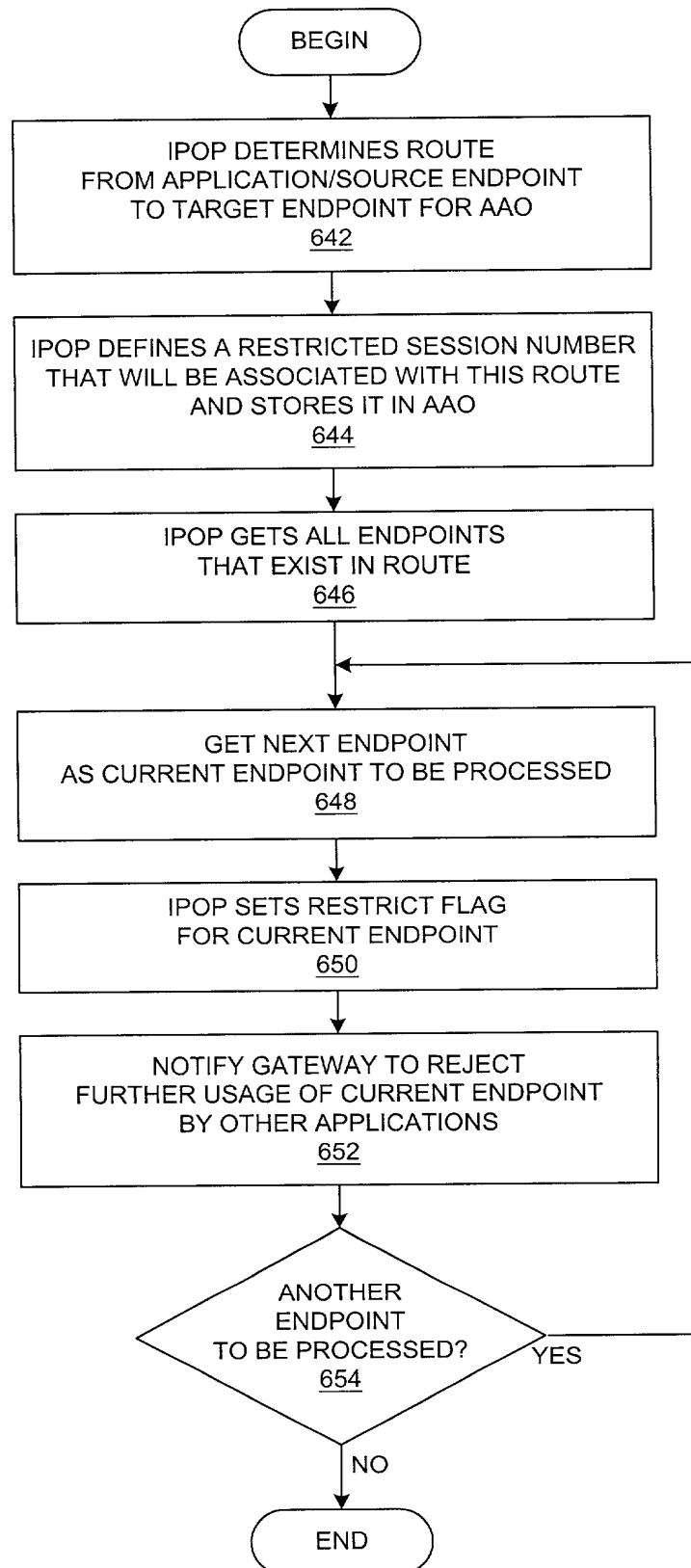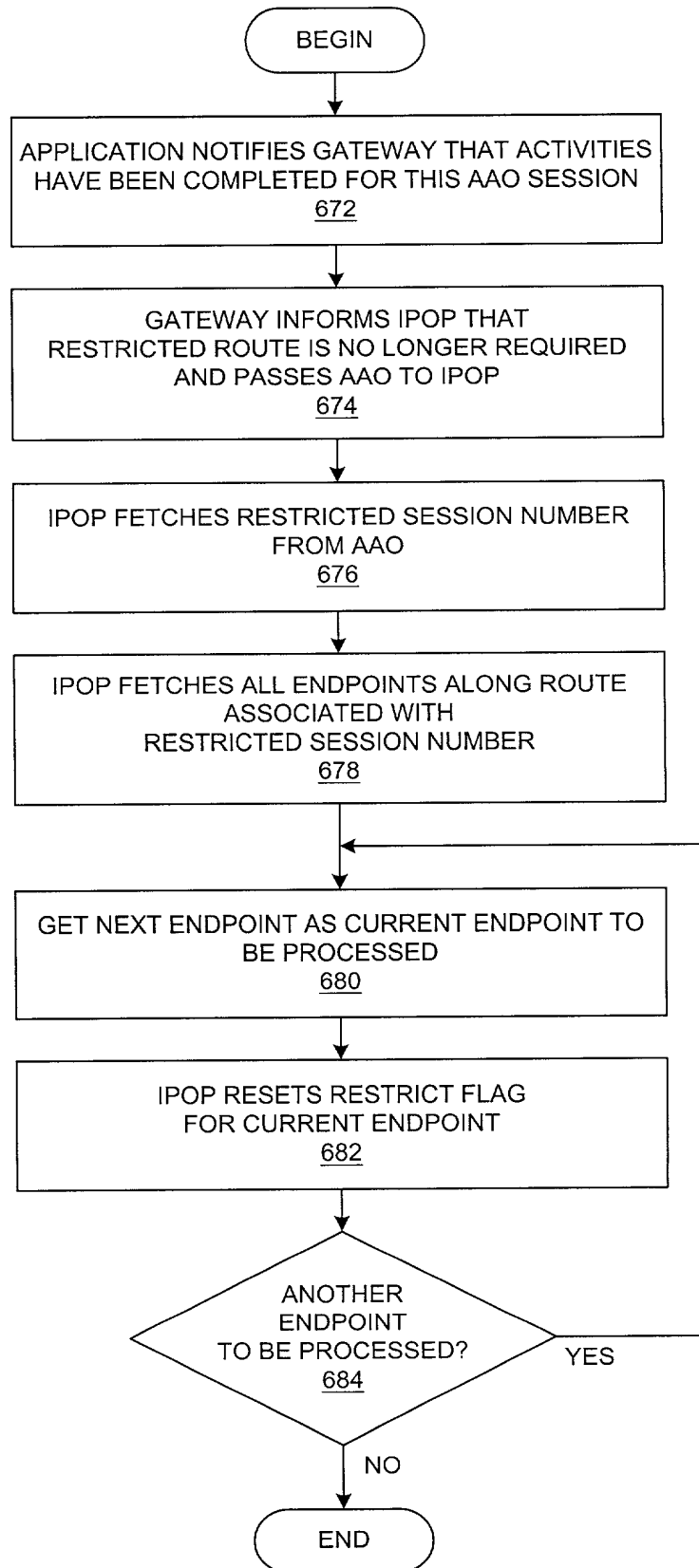
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```
                          ┌──────────────┐
                          │    BEGIN     │
                          └──────┬───────┘
                                 │
                                 ▼
┌─────────────────────────────────────────────────────────────┐
│    APPLICATION NOTIFIES GATEWAY THAT ACTIVITIES              │
│     HAVE BEEN COMPLETED FOR THIS AAO SESSION                 │
│                        672                                   │
└───────────────────────────┬─────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────────┐
│             GATEWAY INFORMS IPOP THAT                       │
│     RESTRICTED ROUTE IS NO LONGER REQUIRED                   │
│             AND PASSES AAO TO IPOP                           │
│                        674                                   │
└───────────────────────────┬─────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────────┐
│    IPOP FETCHES RESTRICTED SESSION NUMBER                   │
│                  FROM AAO                                    │
│                        676                                   │
└───────────────────────────┬─────────────────────────────────┘
                            │
                            ▼
┌─────────────────────────────────────────────────────────────┐
│    IPOP FETCHES ALL ENDPOINTS ALONG ROUTE                   │
│                ASSOCIATED WITH                               │
│            RESTRICTED SESSION NUMBER                         │
│                        678                                   │
└───────────────────────────┬─────────────────────────────────┘
                            │◄─────────────────────────┐
                            ▼                          │
┌─────────────────────────────────────────────────┐   │
│    GET NEXT ENDPOINT AS CURRENT ENDPOINT TO     │   │
│                BE PROCESSED                      │   │
│                    680                           │   │
└───────────────────────┬─────────────────────────┘   │
                        │                              │
                        ▼                              │
┌─────────────────────────────────────────────────┐   │
│          IPOP RESETS RESTRICT FLAG              │   │
│            FOR CURRENT ENDPOINT                  │   │
│                    682                           │   │
└───────────────────────┬─────────────────────────┘   │
                        │                              │
                        ▼                              │
                   ╱─────────╲                         │
                  ╱ ANOTHER   ╲                        │
                 ╱  ENDPOINT    ╲        YES           │
                ╲ TO BE PROCESSED?╱ ────────────────────┘
                 ╲    684       ╱
                  ╲───────────╱
                        │ NO
                        ▼
                 ┌──────────────┐
                 │     END      │
                 └──────────────┘
```

FIG. 6E